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March 24, 2011 *Also Sent Via E-mail*

Tom McCue, Environmental Manager
Siltronic Corporation
7200 NW Front Avenue
Portland, OR 97210

Re: Monitoring Well WS-33-81, DNAPL Data Summary
Siltronic Corporation
Portland, Oregon
ECSI No. 183

Dear Mr. McCue:

The Oregon Department of Environmental Quality (DEQ) reviewed the technical memorandum titled "ISCR-Enhanced Bioremediation Performance Monitoring Data Submittal DNAPL and Groundwater Data – WS-33-81, Siltronic Corporation – ECSI #183" dated January 17, 2011 (WS-33-81 Memorandum). Maul Foster and Alongi, Inc. prepared the WS-33-81 Memorandum for Siltronic Corporation (Siltronic).

The WS-33-81 Memorandum presents the results of analyzing samples of dense non-aqueous phase liquid (DNAPL) collected from monitoring well WS-33-81 from July 2009 through October 2010. During that period of time fifteen samples were collected for analysis. The memorandum also compares the DNAPL results with analyses of groundwater samples collected between February 2009 and October 2010 from the same well, and presents Siltronic's interpretation of the data.

The primary purpose of this letter is to inform Siltronic that DEQ does not accept the interpretations and/or conclusions presented in the WS-33-81 Memorandum regarding trichloroethene (TCE) concentration trends in DNAPL samples. In addition, DEQ considers it premature for Siltronic to draw conclusions regarding the effectiveness of EHC/KB-1 at reducing daughter product concentrations as evaluation of the data being collected is ongoing. This determination does not alter DEQ's previous acknowledgement regarding TCE concentrations in groundwater. DEQ acknowledges concentrations of TCE in groundwater collected from Group 1 and Group 2 performance monitoring wells are currently less than the RAO #1 criterion of 11,000 micrograms per liter (ug/L, or parts per billion)[1].

DEQ's understanding of the information provided in the WS-33-81 Memorandum follows.

[1] 1% of the TCE solubility limit

Overview

DEQ understands from reviewing the WS-33-81 Memorandum and a telephone conversation with James Peale on January 19th that Siltronic interprets the analytical results as follows:

- Aqueous phase TCE concentrations have decreased from 21,400 ug/L to less than 20 ug/L, and concentrations of TCE present in MGP DNAPL declined from 3,480,000 micrograms per kilogram (ug/kg) to less than the reporting limit of 2,500 ug/kg between February 2009 and October 2010, and July 2009 and October 2010 respectively;
- TCE concentrations in the aqueous phase are less than the RAO #1 criterion; and
- The rate TCE is being removed from MGP DNAPL is approximately three times greater than TCE degradation rates in the aqueous phase.

Based on the data trends described above Siltronic concludes:

- TCE degradation in the aqueous phase causes similar but more rapid declines of TCE in MGP DNAPL;
- The mechanism causing removal of TCE from the MGP DNAPL is likely desorption (i.e., TCE desorption from the non-aqueous phase to the aqueous phase);
- Desorption rates are driven largely by the TCE concentration gradient between the non-aqueous and aqueous phases;
- Assuming TCE removal is due to desorption (i.e., as opposed to dechlorination in the non-aqueous phase), the data suggest the concentration gradient is causing desorption of TCE from the non-aqueous phase to the aqueous phase where dechlorination occurs.

DEQ's comments on the WS-33-81 Memorandum and our assessment of the data and data trends are provided below.

TCE Data and Data Trends

In general, DEQ finds Siltronic's data interpretations and conclusions to be limited by presuming declines in TCE concentrations in DNAPL result from a concentration-gradient driven desorption process. Essentially, Siltronic treats WS-33-81 as a laboratory bench test in which TCE concentrations in DNAPL are considered to be uniform, and the dominant variable influencing TCE concentrations over time is desorption. This presumption is unrealistic given the complex nature of the subsurface, the significant contaminant concentrations present, and the presence of multiple phases. Except for dechlorination of TCE in the non-aqueous phase, the WS-33-81 Memorandum does not mention other factors which could potentially influence the chemical composition of DNAPL in the subsurface, including but not limited to the following:

- Chemical heterogeneity of DNAPL within a source zone contributing to WS-33-81;
- Potential for multiple sources zones to contribute DNAPL to the well (field observation notes were lost in a vehicle fire);
- Reduction in chlorinated volatile organic compounds (cVOCs) concentrations as DNAPL migrates downward through the sand pack and into the monitoring well sump;

- Depletion of DNAPL source zones with higher TCE concentrations; and
- Length of time DNAPL is in contact with cVOCs prior to removal.

Based on DEQ's review of the data collected from WS-33-81, there appears to be evidence of factors other than desorption influencing TCE concentrations and concentration trends, including the following:

- Concentrations of TCE in DNAPL vary substantially over short periods of time. In two cases TCE concentrations decreased more than 2,000% between consecutive sampling events (i.e., the October 28 [4,200,000 ug/kg] and December 10, 2009 [155,000 ug/kg] and January 18 [141,000 ug/kg] and February 15, 2010 [6,510 ug/kg] events). In another case the TCE concentration increased over 150% compared to the sample collected two weeks prior (i.e., October 15 [2,570,000 ug/kg] and October 28, 2009 [4,200,000 ug/kg] events). It is our expectation that desorption dominated processes involving DNAPL with a uniform composition would result in more consistent and less dramatic variations in concentrations.
- The largest declines in TCE concentrations in groundwater occur months before DNAPL trends decrease. In discussing the TCE concentration gradient between non-aqeous and aqueous phases, Siltronic indicates, "The data show a coincident decline in the gradient and removal rate." As indicated in the WS-33-81 Memorandum, the most significant declines in TCE concentrations in groundwater occur prior to June 2009 (21,400 ug/L [February 11, 2009] to 500 ug/L [May 26, 2009]). However, TCE concentrations in DNAPL range between 2,570,000 and 4,200,000 ug/kg through October 2009 before dropping to 155,000 ug/kg over a six week period between late October and mid-December 2009. If desorption is the dominant factor influencing TCE concentrations in groundwater and DNAPL, it would seem reasonable to expect concentrations trends to correspond approximately in time.
- The concentrations and trends of cis-1,2-dichloroethene (cis-1,2-DCE) in DNAPL mimic those of TCE through February 2010 before diverging. However, from April 2009 through December 2010, cis-1,2-DCE concentrations in groundwater are generally greater than 100,000 ug/L and exhibit a slight overall downward trend. In other words, although cis-1,2-DCE concentrations in DNAPL show a corresponding and similar magnitude drop compared to TCE between October 2009 (5,940,000 ug/kg) and December 2009 (736,000 ug/kg), the decrease does not appear to be related to cis-1,2-DCE concentrations groundwater. This information suggests a mechanism other than desorption is influencing cVOC concentrations in the DNAPL (e.g., changes in the overall composition of the DNAPL entering the well).

Summary

In summary, the WS-33-81 Memorandum relies on overly simplifying assumptions (i.e., TCE is uniformly distributed in DNAPL entering the well; large changes in contaminant concentrations from one sampling event to the next are "reliable" indicator of desorption and solute-phase biodegradation; declines in TCE concentrations result largely from desorption) and does not consider other factors that could influence interpretations of the data and data trends. Based on this information and evaluation of cVOC data and data trends, DEQ does not accept Siltronic's interpretations and/or conclusions regarding TCE trends in DNAPL.

Please remember that the original objective of collecting and analyzing DNAPL samples was to support an assessment of whether TCE DNAPL occurs in the subsurface. This is not mentioned or discussed in the memorandum. Within thirty days of receiving this letter Siltronic should revise and resubmit the DNAPL data evaluation for WS-33-81 to address this objective.

Please call me at (503) 229-5543 if you have questions regarding this letter.

Sincerely,

Dana Bayuk, Project Manager
NWR Cleanup Section

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